



Haste makes waste during balancing

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During a recent balancing job, I was reminded of the adage, "Haste makes waste." The machine train in question is a tandem compound 880 MW steam turbine operating at 1800 rpm. It consists of a high pressure turbine (HP), two double flow low pressure turbines (DFLP), a generator and an exciter. The combined length of the unit is half a football field long (45 metres or 150 feet).

The unit had just come out of a refueling outage and some reblading work had been done on the #2 DFLP. When the unit was started and operated at 25% load, vibration amplitudes at the governor end caused the monitor to go into Alert. The overall reading was 188 μm (7.4 mils) peak to peak absolute. The 1X compensated amplitudes were 140 μm (5.5 mils) peak to peak absolute and 51 μm (2.0 mils) peak to peak relative. This unit has a very flexible bearing support, which is obvious by comparing the absolute to relative amplitudes.

Considering the high vibration values and operation near a balance resonance, a conservative weight of 680 grams (24 ounces) was installed. During installation, the rotor was off turning gear for approximately six minutes. Typically, the rotor would be rotated 180° and held for six more minutes to reduce the thermal rotor bow. In this case, management wanted to quickly come back online, and the rotor was held in the 180° position for only three minutes.

The unit returned to service at 25% load, but the vibration readings were **exactly** the same amplitude and phase. What was the problem?

We had been on-site for 16 hours and the customer's regulations required us to leave the site for 8 hours. During that time, we left a 108 Data Acquisition Instrument sampling on a delta time mode. When we returned, vibration levels were lower (3.5 mils peak to peak 1X compensated absolute and 1.4 mils peak to peak 1X compensated relative). The Amplitude and Phase versus Time (APHT) plot (Figure 1) shows the change in vibration over time. It appears that the rotor bowed. During operation, the bow was relieved. Three minutes of time off turning gear would have saved a lot of speculation and probably a few gray hairs.

Conclusion

The unit was now operating out of the Alert range, satisfying the plant's personnel. As the load was increased, vibration levels decreased further. Rotating the rotor 180° and holding it there for a few more minutes before startup would have reduced the rotor thermal bow and the confusion it generated due to high "vibration" readings. ■



Figure 1
APHT plot showing sag working itself out.